The Latex Serologic Test For Syphilis

A New Screening Procedure

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■ *A new macroscopic screening test for syphilis, the Latex-*STS *test, is extraordinarily simple. After inactivation of the patient's serum for 30 minutes at 56°C the test is performed by mixing the patient's serum with latex particles coated with cardiolipin and a protein fraction obtained from the non-pathogenic Reiter strain of* Treponema pallidum. *Two to three minutes after mixing, the result of the test is observed on a ringed serologic plate. The sensitivity, specificity and reproducibility of the new test are equivalent to those of the qualitative Venereal Disease Research Laboratory tube test. The advantages of the Latex-*STS *are that it can be done in a short time, it is simple and it requires a minimum of laboratory equipment. The coated latex particles are stable for 12 months.*

A MACROFLOCCULATION TEST for syphilis using a cardiolipin-lecithin antigen was described in 1948 by Harris, Rosenberg and Del Vecchio[3] at the Venereal Disease Research Laboratory of the U.S. Public Health Service. Subsequently the test became known as the VDRL test and has been widely used during the past 18 years as a standard routine screening test for syphilis. Three modifications of the test have been developed: (a) A slide test, (b) a qualitative tube test and (c) a quantitative tube test.

Portnoy, Garson and Smith[7] in 1957 introduced a rapid plasma reagin test, the RPR test. The advantage of the test was its use for rapid and economical screening of large numbers of sera. More recently other rapid screening tests have been described, such as the plasmacrit test by Andujar and Mazurek in 1959[1] and the unheated serum reagin test (USR) by Portnoy, Bossak, Falcone and Harris in 1961.[6] The present report is an evaluation of a simple screening test for syphilis, which is designated the Latex-STS.

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Presented before the Section on Preventive Medicine and Public Health at the 95th Annual Session of the California Medical Association, Los Angeles, 19 to 23 March 1966.

Dr. Carpenter died 25 March 1966.

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Materials and Methods

Five hundred forty specimens of serum were tested. Ninety were from patients known to have or to have had syphilis which were selected on a basis of darkfield examinations, results of *Treponema pallidum* immobilization (TPI) tests, and on a clinical history of syphilis. They included 20 primary, 20 secondary, 20 latent, 20 late and 10 congenital cases of the disease. Other specimens tested included 100 from the Los Angeles County Health Department obtained for routine premarital and prenatal blood tests and presumed to be non-syphilitic. One hundred specimens were from biologic false positive (BFP) reactors which were selected on a basis of one or more reactive serologic tests, a negative TPI test and a history of disease often associated with BFP reactions. Fifty specimens of serum previously tested in several different laboratories by the Reiter Protein Complement Fixation test (RPCF) and submitted for the TPI test were likewise evaluated. One hundred specimens taken at random as they were received at the TPI laboratory were subsequently tested with the TPI, VDRL and Latex-STS procedures. Ten specimens of spinal fluid were also included in the study.

Non-Treponemal Tests

VDRL *Test* — The qualitative VDRL tube test was performed as recommended by the United States Public Health Service and described in the Manual of Serologic Tests for Syphilis.[4]

Latex-STS—The technique used for the Latex-STS was performed as follows: Serum was inactivated at 56°C for 30 minutes. Two drops of the patient's serum were placed on a ringed serologic plate with a standardized capillary pipette. One drop of antigen,* which consisted of polystyrene latex particles ranging in diameter from 0.15 to 0.4 microns coated with cardiolipin and Reiter protein, was then added and subsequently mixed with the serum, using a wooden applicator. The coated latex particles were suspended in a glycine buffered saline solution, pH 8.2, to which a dye, brilliant green, was added to facilitate reading of the reaction. The plate was gently tilted up and down for two minutes, after which the reaction was observed macroscopically for flocculation.

*Provided by the Research Division of the Hyland Laboratories.

Treponemal Tests

RPCF *Test*—The Reiter Protein Complement Fixation test (RPCF) was performed in various laboratories before the specimens were submitted for the TPI test.

TPI *Test*—The *Treponema pallidum* immobilization test was performed as described by Nelson and Mayer[5] with the modification recommended by Boak and Miller.[2]

Results

Reactive and weakly reactive tests were observed with approximately equal frequency in both the VDRL and Latex-STS tests. In the evaluation, weakly reactive flocculation tests were considered to be reactive tests.

Sensitivity. The sensitivity of the qualitative VDRL tube test ranged from 40 to 80 per cent depending upon the stage of syphilitic infection. It was 66 per cent for the group of 90 specimens of syphilitic serum. For each type of primary and secondary syphilis it was 80 per cent; for latent, 40 per cent; for late, 70 per cent; and for congenital syphilis, 50 per cent. The sensitivity of the Latex-STS for the group of 90 specimens as a whole was 69 per cent. By categories, the sensitivity was: Primary, 85 per cent; secondary, 80 per cent; latent, 60 per cent; late, 65 per cent; congenital, 40 per cent. (See Table 1.)

Specificity. The specificity was determined on 200 specimens of serum, of which 100 were prenatal and premarital specimens presumed to be non-syphilitic. The other hundred specimens were BFP as determined by the TPI test. The specificity of the VDRL and of the Latex-STS tests on the 200 specimens was 86 per cent for both procedures. The specificity of the VDRL test on the 100 specimens presumed to be non-syphilitic was 100 per cent, and for the 100 BFP specimens, it was 71 per cent. By the Latex-STS procedure it was 97 per cent for the non-syphilitic specimens and 74 per cent for the BFP specimens. A comparison of the results of the VDRL and Latex-STS tests with those of the RPCF test showed an equal agreement of 50 per cent.

The results of the comparative studies on the 100 specimens taken at random as they were submitted for the TPI test were reactive in 29 per cent and non-reactive in 71 per cent. The VDRL tests were reactive in only 36 per cent and

non-reactive in 64 per cent. The Latex-STS were reactive in 41 per cent and non-reactive in 59 per cent. The results of the VDRL test were in agreement with the TPI test in 65 per cent and with the Latex-STS in 64 per cent of the cases. The 10 specimens of spinal fluid were non-reactive with the TPI, VDRL and Latex-STS tests.

Discussion

An evaluation of the results of the Latex-STS on 540 specimens of serum and on 10 spinal fluid specimens with the results of the qualitative VDRL tube test demonstrated the sensitivity, specificity and reproducibility of the two tests to be equivalent. Thus the Latex-STS should become a valuable syphilis control procedure in physicians' offices, in public health laboratories, in blood banks and in international epidemiologic surveys for syphilis because it has several outstanding advantages over the VDRL test. It is rapidly and simply performed with a minimum amount of laboratory equipment. The qualitative VDRL tube test was selected for the comparative evaluation inasmuch as it has greater accuracy than the slide VDRL test. It is possible for one technician to process 300 Latex-STS tests in one day. The number of tests could be increased by substituting a three-minute inactivation time at 62°C. An evaluation with the "short" inactivation time has not been made in this laboratory, however.

It is well known that the non-treponemal tests are non-specific and have a definite limitation in the diagnosis of syphilis. Because of economy and relative ease of performance, however, they are invaluable as screening tests for the infection. Negative STS tests occur in early syphilis and even in a certain proportion of cases of syphilis of many years' duration. Also reactive STS tests are observed in certain non-syphilitic acute and chronic diseases as well as in narcotic addiction and in pregnancy. A significant finding in this evaluation is that only 36 per cent of the 100 specimens submitted for the TPI test were reactive to the VDRL test when retested in this laboratory even though VDRL tests made by the referring laboratory were reported reactive for 95 per cent of the specimens received. Because of its simplicity the Latex-STS may aid in bringing about a greater uniformity of results in interlaboratory non-treponemal tests for syphilis.

TABLE 1.—*Results of a New Screening Test for Syphilis—The Latex-STS*

		Test											
		TPI				*VDRL+*				*Latex-STS*			
		Reactive		*Nonreactive*		*Reactive*		*Nonreactive*		*Reactive*		*Nonreactive*	
Diagnostic Category	*Number of Specimens**	*Number*	*Per Cent*	*Number*	*Per Cent*	*Number*	*Per Cent*	*Number*	*Per Cent*	*Number*	*Per Cent*	*Number*	*Per Cent*
SYPHILIS													
Primary	20	**	.....	.....	.....	16	80	4	20	17	85	3	15
Secondary	20	**	.....	.....	.....	16	80	4	20	16	80	4	20
Latent	20	20	100	0	0	8	40	12	60	12	60	8	40
Late	20	20	100	0	0	14	70	6	30	13	65	7	35
Congenital	10	8	80	2	20	5	50	5	50	4	40	6	60
Total	90	.....	.....	.....	.....	59	66	31	34	62	69	28	31
NON-SYPHILIS													
Presumed Non-syphilitic	100	***	.....	.....	.....	0	0	100	100	3	3	97	97
Biologic false positive	100	0	0	100	100	29	29	71	71	26	26	74	74
Total	200	.....	.....	.....	.....	29	14	171	86	29	14	171	86
PROBLEM SERA FOR TPI TEST	100	29	29	71	71	36	36	64	64	41	41	59	59
SPINAL FLUIDS	10	0	0	10	100	0	0	10	100	0	0	10	100
SERA SELECTED FOR REPRODUCIBILITY	100					—88 per cent—				—90 per cent—			

*A total of 540 specimens tested. The antigen was provided by the Research Division of Hyland Laboratories.
**Diagnosis in primary and secondary syphilis based upon darkfield positive examination or a reactive TPI test.
***TPI tests not performed on these specimens (premarital and prenatal specimens).
+Qualitative VDRL tube test.

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